

- 31 Requena F. Estructura social y mercado de trabajo. (Social structure and labour market). *Estudios Regionales* 1990;27:73–105. Available at: <http://www.revistaestudiosregionales.com/pdfs/pdf316.pdf> (date last accessed April 2010).
- 32 Agudelo-Suárez A, Gil-González D, Ronda-Pérez D, et al. Discrimination, work and health in immigrant populations in Spain. *Soc Sci Med* 2009;68:1866–74.
- 33 Ahonen EQ, López-Jacob MJ, Vázquez ML, et al. Invisible work, unseen hazards, the health of women immigrant household service workers in Spain. *Am J Ind Med* 2010;53:405–16.
- 34 Monada S, Llorens C, Font A, et al. Exposición a riesgos psicosociales entre la población asalariada en España (2004–2005): valores de referencia de las 21 dimensiones del cuestionario COPSOQ ISTAS1 (Exposure to psychosocial risk among the working population in Spain (2004–2005): referent values of the 21 dimensions of the questionnaire COPSOQ ISTAS21). *Rev Esp Salud Publica* 2008;82:667–75.
- 35 Padrón Municipal 2005. Available at: <http://www.ine.es> (date last accessed November 2010).
- 36 González C. Los otros inmigrantes: los europeos comunitarios de países ricos. (The others immigrants: Communities Europeans of rich countries). Documento de trabajo. Available at: <http://www.realinstitutoelcano.org> (date last accessed December 2008).
- 37 Roa MG. Condiciones laborales y precariedad de los inmigrantes. El caso de los colombianos en tres comarcas de la provincia de Barcelona. (Working conditions and precarious of the immigrants. The case of Colombians in three districts of the province of Barcelona). Documentos CIDOB. Migraciones; 14. Available at: http://www.cidob.org/es/publicaciones/documentos_cidob/migraciones/num_14_condiciones_laborales_y_precariedad_de_los_inmigrantes_el_caso_de_los_colombianos_en_tres_comarcas_de_la_provincia_de-Barcelona (date last accessed September 2009).

.....
European Journal of Public Health, Vol. 22, No. 5, 693–699

© The Author 2011. Published by Oxford University Press on behalf of the European Public Health Association. All rights reserved.
doi:10.1093/eurpub/ckr099 Advance Access published on 15 September 2011

Effectiveness of the European Union text-only cigarette health warnings: findings from four countries

Sara C. Hitchman¹, Ute Mons², Gera E. Nagelhout^{3,4}, Romain Guignard⁵, Ann McNeill⁶, Marc C. Willemsen^{3,4}, Pete Driezen⁷, Jean-Louis Wilquin⁵, François Beck^{5,8}, Enguerrand Du-Roscoat⁵, Martina Pötschke-Langer², David Hammond⁹, Geoffrey T. Fong^{1,10}

- 1 Department of Psychology, University of Waterloo, Waterloo, Ontario, Canada
- 2 Unit Cancer Prevention and WHO Collaborating Centre for Tobacco Control, German Cancer Research Center (DKFZ), Heidelberg, Germany
- 3 Maastricht University/CAPHRI, Maastricht, The Netherlands
- 4 STIVORO for a smoke free future, The Hague, The Netherlands
- 5 French Institute for Health Promotion and Health Education (INPES), Saint-Denis, France
- 6 Division of Epidemiology and Public Health, UK Centre for Tobacco Control Studies, University of Nottingham, Nottingham, UK
- 7 Propel Centre for Population Health Impact, University of Waterloo, Waterloo, Ontario, Canada
- 8 Cermes3 – Cesames Team (Research Centre Medicine, Sciences, Health, Mental Health, Health Policy), University of Paris Descartes, EHESS, Paris, France
- 9 Department of Health Studies and Gerontology, University of Waterloo, Waterloo, Ontario, Canada
- 10 Ontario Institute for Cancer Research, Toronto, Ontario, Canada

Correspondence: Sara C. Hitchman, Department of Psychology, University of Waterloo, Waterloo, Ontario, Canada, N2L 3G1, tel: +011 519 888-4567 (ext 33597); fax: 599-746-8631; e-mail: schitchm@uwaterloo.ca

Background: The European Commission requires tobacco products sold in the European Union to display standardized text health warnings. This article examines the effectiveness of the text health warnings among daily cigarette smokers in four Member States. **Methods:** Data were drawn from nationally representative samples of smokers from the International Tobacco Control Policy Evaluation Project surveys in France (2007), Germany (2007), the Netherlands (2008) and the UK (2006). We examined: (i) smokers' ratings of the health warnings on warning salience, thoughts of harm and quitting and forgoing of cigarettes; (ii) impact of the warnings using a Labels Impact Index (LII), with higher scores signifying greater impact; and (iii) differences on the LII by demographic characteristics and smoking behaviour. **Results:** Scores on the LII differed significantly across countries. Scores were highest in France, lower in the UK, and lowest in Germany and the Netherlands. Across all countries, scores were significantly higher among low-income smokers, smokers who had made a quit attempt in the past year and smokers who smoked fewer cigarettes per day. **Conclusion:** The impact of the health warnings varies greatly across countries. Impact tended to be highest in countries with more comprehensive tobacco control programmes. Because the impact of the warnings was highest among smokers with the lowest socioeconomic status (SES), this research suggests that health warnings could be more effective among smokers from lower SES groups. Differences in warning label impact by SES should be further investigated.

Introduction

Tobacco use is the leading cause of preventable death in the European Union (EU). Approximately 507 000 males and 148 000 females died from smoking attributable causes in the EU25 in the year 2000, representing 23% of total male deaths and 7% of total female deaths.¹

Health warning labels are recommended by the World Health Organization (WHO) as a measure to reduce the demand for tobacco and are required under Article 11 by parties to the WHO Framework Convention on Tobacco Control (FCTC).² Studies show that large, prominent health warnings are effective for informing smokers and

non-smokers about the risks of smoking, motivating smokers to quit and promoting quit-related behaviours.^{3–12}

In 2003, Directive 2001/37/EC came into effect requiring that all cigarettes sold in the EU carry health warnings¹³ that: (i) cover 30% of the front of the package and 40% of the back; (ii) are printed in standardized black text with a white background and black border; and (iii) carry one of two main warnings on the front of the pack ('smoking kills' or 'smoking seriously harms you and others around you') and one of 14 warnings on the back of the pack, to be rotated on a regular basis (supplementary figures 1 and 2). One distinction is that the warning, 'smoking kills', reads 'smoking *can* kill', in some countries, e.g.

Germany. Prior to Directive 2001/37/EC, warnings were only required to cover 4% of the package, with no exact specifications for colour or typeface.¹⁴ In 2004, the European Commission (EC) issued 42 pictorial warnings that Member States could implement. To date, seven Member States use a selection of these warnings (Belgium, France, Latvia, Malta, Romania, Spain and the UK).

Several studies examined the effectiveness of the EU text-only warnings in the UK before pictorial warnings were implemented. A longitudinal study of smokers in Australia, Canada, the USA and the UK found that after the introduction of the EU text-only warnings in the UK, UK smokers' responses to the warnings on key indicators of effectiveness increased in comparison with the previous smaller UK warnings.¹⁵ The same study also found that UK smokers' ratings of the EU text-only warnings for inducing quit-related behaviours and cognitions were higher than US smokers' ratings of the smaller US text-only warnings, but lower than Canadian smokers' responses to the larger Canadian pictorial warnings when controlling for implementation date.¹⁵ Other studies found that UK smokers reported increased awareness and depth of processing of the EU text-only warnings after their implementation,¹⁶ but that such warnings exhibited more 'wear out' than the Canadian pictorial warnings.¹⁷ A study of UK adolescents found high salience of the EU text-only warnings, but low reports of thinking about them.⁴

Studies outside the UK have reported similar findings. A cross-sectional survey of Dutch smokers found that smokers who intended to quit were particularly responsive to the EU text-only warnings, with reports of motivation to quit and stop smoking by some smokers.⁸ A focus group study of French smokers and non-smokers found that the EU text-only warnings were rated as less effective than the EU pictorial warnings.¹⁸

Because the text-only warnings are near identical across the EU (with the exception of warning choice for the front cover and language), there is a unique opportunity to compare the effectiveness of the warnings across EU Member States.

Two previous efforts that examined the effectiveness of the EU text-only warnings found country differences. The 2008 Eurobarometer Survey on Tobacco found that the per cent of smokers who said the warnings were very or somewhat effective in getting them to try to quit was an average of 17% across countries without pictorial warnings (from 8% in Austria to 25% in Lithuania).⁹ A focus group of smokers from seven EU Member States also found differences, such that Southern Europeans seemed less receptive to the warnings.¹⁹ However, the 2008 Eurobarometer did not adjust for demographics and smoking behaviour or provide formal tests of significance, and the focus group was qualitative in nature, leading to uncertainties about reasons for the differences.

This study sought to examine the effectiveness of the current EU text-only health warnings across the four nationally representative samples of smokers from the International Tobacco Control (ITC) Project Europe Surveys in France, Germany, the Netherlands and the UK. The ITC Project (comprising prospective cohort surveys of smokers and non-smokers in 20 countries) is designed to evaluate the psychosocial and behavioural impact of WHO's FCTC. Smokers' ratings of the health warnings on key measures of warning label effectiveness were combined to generate a Labels Impact Index (LII), with higher scores indicating greater health warning effectiveness. Scores on the LII were then compared across countries, adjusting for demographics and smoking behaviour.

Associations between demographics and smoking behaviour and scores on the LII were also examined because previous research has found

differences in health warning effectiveness by individuals' demographics and smoking behaviours.^{8,9,20} Additionally, because prevalence rates of smoking are highest among those with low education in the EU,^{21–24} there is a need to understand the possible differential impact of tobacco control policies by socioeconomic status (SES).

Methods

Respondents

Respondents were daily smokers (≥ 18 years of age) from France ($n = 1,532$), Germany ($n = 1,305$), the Netherlands ($n = 1,788$) and the UK ($n = 1,788$). Respondents with missing data were deleted. All countries had the standardized EU text-only health warnings in place during the survey period/wave chosen for analyses (UK did not yet have pictorial warnings) (table 1).

Procedures

Respondents from all countries, with the exception of the Netherlands, were selected using random digit dialling. Interviews were conducted using computer-assisted telephone interviewing (CATI). In the Netherlands, two different sampling and survey modes were used: (i) a CATI sample ($n = 404$); and (ii) a computer-assisted web interviewing (CAWI) sample ($n = 1,668$). Respondents for the CAWI sample were drawn from a population-based Internet panel, TNS NIPObase.²⁵

Samples were stratified geographically, with the exception of France, where the design was a simple random sample. Analyses were weighted on sex and age to ensure samples in each country were nationally representative of smokers in the general population. Further details on methodology may be found elsewhere.^{25,26–28,29}

Survey cooperation rates (calculated using American Association for Public Opinion Research COOP4) were: France (75.3%), Germany (94.9%), the Netherlands CATI (78.1%), the Netherlands CAWI (78.1%) and the UK (87.3%).

Measures

Demographics

Demographic variables included sex, age, minority status, net household income and education. See table 2 for categories. Minority status was coded as: France: French only spoken at home vs. otherwise; Germany: German nationality vs. otherwise; the Netherlands: both parents born in the Netherlands vs. otherwise; and UK: white vs. otherwise.

Smoking behaviour

Measures included: cigarettes per day (0–10, 11–20, 21–30 or >30); time to first cigarette after waking in minutes (5, 6–30, 31–60 or >60); past year quit attempts (at least one vs. no attempt); and intentions to quit (within the next month; within the next 6 months; sometime in the future—beyond 6 months; or no plans to quit). 'Intentions to quit' was dichotomized as plan to quit in the next 6 months vs. otherwise. Roll your own (RYO) tobacco use was assessed (exclusively smokes RYO tobacco; smokes factory-made; or smokes factory-made and RYO tobacco). However, RYO use was not adjusted for in final models because it was not associated with measures of warning label effectiveness.

Table 1 Survey dates and text-only health warning label implementation dates

Country	Survey wave	Survey dates	Health warnings implemented	Time from health warning introduction to surveying (years)
The Netherlands	Wave 1	March–April 2008	2002 June	6
France	Wave 1	December 2006–February 2007	2003 September	3–4
UK	Wave 5	October 2006–February 2007	2003 February	3–4
Germany	Wave 1	July–November 2007	2003 October	4

Table 2 Demographic characteristics and smoking behaviours of daily smokers across four European countries ($n=6174$)^{a,b}

Characteristic	DE, n (%)	FR, n (%)	UK, n (%)	NL ^c , n (%)	NL tel ^d , n (%)	NL web ^d , n (%)
Sex ^e						
Male	621 (47.6)	759 (49.5)	662 (42.7)	948 (53.0)	190 (54.6)	758 (52.6)
Female	684 (52.4)	773 (50.5)	887 (57.3)	840 (47.0)	158 (45.4)	682 (47.4)
Age ^e (years)						
18–24	194 (14.9)	212 (13.8)	89 (5.7)	280 (15.7)	38 (10.9)	242 (16.8)
25–39	323 (24.8)	550 (35.9)	421 (27.2)	635 (35.5)	90 (25.9)	545 (37.8)
40–54	532 (40.8)	574 (37.5)	576 (37.2)	537 (30.0)	128 (36.8)	409 (28.4)
55+	256 (19.6)	196 (12.8)	463 (29.9)	336 (18.8)	92 (26.4)	244 (16.9)
Minority status ^e						
Majority group	1257 (96.3)	1330 (86.8)	1487 (96.0)	1619 (90.5)	309 (88.8)	1310 (91.0)
Minority group	48 (3.7)	202 (13.2)	62 (4.0)	169 (9.5)	39 (11.2)	130 (9.0)
Income ^e						
Low	334 (25.6)	449 (29.3)	529 (34.2)	270 (15.1)	46 (13.2)	224 (15.6)
Moderate	509 (39.0)	673 (43.9)	483 (31.2)	595 (33.3)	104 (29.9)	491 (34.1)
High	266 (20.4)	363 (23.7)	405 (26.1)	536 (30.0)	128 (36.8)	408 (28.3)
Not reported	196 (15.0)	47 (3.1)	132 (8.5)	387 (21.6)	70 (20.1)	317 (22.0)
Education ^e						
Low	298 (22.8)	716 (46.7)	934 (60.3)	571 (31.9)	82 (23.6)	489 (34.0)
Moderate	509 (39.0)	541 (35.3)	418 (27.0)	852 (47.7)	186 (53.4)	666 (46.3)
High	498 (38.2)	275 (18.0)	197 (12.7)	365 (20.4)	80 (23.0)	285 (19.8)
Exclusively smokes RYO ^{e,f}						
Smokes FM or FM+ RYO	1141 (87.4)	1336 (87.2)	1183 (76.4)	1271 (71.1)	229 (65.8)	1042 (72.4)
Smokes exclusively RYO	164 (12.6)	196 (12.8)	366 (23.6)	517 (28.9)	119 (34.2)	398 (27.6)
Cigarettes/day ^e						
0–10	401 (30.7)	729 (47.6)	432 (27.9)	521 (29.1)	101 (29.0)	420 (29.2)
11–20	695 (53.3)	676 (44.1)	877 (56.6)	979 (54.8)	186 (53.4)	793 (55.1)
21–30	166 (12.7)	103 (6.7)	171 (11.0)	244 (13.6)	50 (14.4)	194 (13.5)
31+	43 (3.3)	24 (1.6)	69 (4.5)	44 (2.5)	11 (3.2)	33 (2.3)
Time to first cigarette ^e (min)						
61+	361 (27.7)	490 (32.0)	206 (13.3)	343 (19.2)	72 20.7 ()	271 (18.8)
31–60	379 (29.0)	326 (21.3)	321 (20.7)	254 (14.2)	64 (18.4)	190 (13.2)
6–30	453 (34.7)	558 (36.4)	730 (47.1)	837 (46.8)	153 (44.0)	684 (47.5)
Within 5	112 (8.6)	158 (10.3)	292 (18.9)	354 (19.8)	59 (17.0)	295 (20.5)
Intentions to quit ^e						
In next 6 months	316 (24.2)	591 (38.6)	499 (32.2)	397 (22.2)	85 (24.4)	312 (21.7)
Otherwise	989 (75.8)	941 (61.4)	1050 (67.8)	1391 (77.8)	263 (75.6)	1128 (78.3)
Past year quit attempts ^e						
No attempt	974 (74.6)	1131 (73.8)	1330 (85.9)	1298 (72.6)	256 (73.6)	1042 (72.4)
At least one	331 (25.4)	401 (26.2)	219 (14.1)	490 (27.4)	92 (26.4)	398 (27.6)

a: DE = Germany, FR = France, UK = United Kingdom, NL = Netherlands.

b: Descriptive data shown are unweighted.

c: NL = NL Tel + NL Web, all statistical analyses use combined NL sample.

d: Tel = respondents surveyed by telephone; web = respondents surveyed by web.

e: $P < 0.001$, based on a χ^2 -test, country difference only.

f: RYO = RYO tobacco, FM = factory made (cigarettes).

Health warning effectiveness measures

The four individual measures were dichotomized as: (i) warning salience: in the last month, how often, if at all, have you noticed the warning labels on cigarette packages (very often or often vs. sometimes, rarely or never)? (ii) Thoughts of harm: to what extent, if at all, do the warning labels make you think about the health risks of smoking (a lot vs. somewhat, a little or not at all)? (iii) Thoughts of quitting: to what extent, if at all, do the warning labels on cigarette packs make you more likely to quit smoking (a lot vs. somewhat, a little or not at all)? (iv) Forgoing of cigarettes: in the last month, have the warning labels stopped you from having a cigarette when you were about to smoke one (many times, a few times or once vs. never)?

Labels Impact Index (LII)

The LII was calculated using the original four/five-point scales of the individual measures of health warning effectiveness, i.e. not dichotomized. The measures were standardized by subtracting the overall mean from each respondent's score and dividing by the standard deviation. Weights were applied to each measure to create the LII based on findings from a longitudinal study by Borland *et al.*¹⁰ that used data from the ITC project surveys in Australia, Canada, the USA and the UK (same health warning measures as the present study). Borland *et*

*al.*¹⁰ found that warning salience was not a strong predictor of quit attempts (although there was a bivariate association), and that cognitive (thoughts of harm and quitting) and behavioural (forgoing a cigarette) measures were significant predictors of quit attempts in multivariate models, with the behavioural measure showing some evidence of being a stronger direct predictor.¹⁰

Thus, the LII weights warning salience the least followed by cognitive and then behavioural measures, as follows: LII = (SALIENCE*1) + (HARM*2) + (QUITTING*2) + (FORGO*3), with higher scores on the LII signifying greater impact.

Statistical analyses

All analyses were conducted with weighted data and methods appropriate for complex survey data using SAS 9.1. Pearson χ^2 -tests were used to test whether samples differed on demographics and smoking behaviour. Three main analyses were conducted: (i) separate logistic regression analyses were conducted to test for differences on each measure of health warning effectiveness across countries with the dichotomized version of each measure set as the dependent variable; (ii) linear regression analysis was conducted to test for differences on the LII across countries; and (iii) separate linear regressions for each demographic and smoking behaviour variable by country interaction were conducted to test if demographic and smoking variables differentially predicted the

LII across countries. All regression models adjusted for demographic and smoking behaviour variables. Because the Netherlands's survey used two different modes (web and telephone) the samples were combined, and an indicator variable was added for mode in all regression models. All tables display descriptive statistics for the Netherlands combined sample and the separate web and telephone samples for illustrative purposes.

Results

Characteristics of the study sample

There were significant demographic and smoking behaviour differences between the countries at the $P < 0.001$ level based on χ^2 -tests (table 2). For example, the Netherlands sample had a greater proportion of male respondents compared with the other countries. The French sample reported a lower number of cigarettes per day. Smokers in the Netherlands and Germany were less likely to intend to quit.

Health warning effectiveness measures

Logistic regression models demonstrated that the individual measures of health warning effectiveness differed significantly across the four countries (table 3). Smokers in Germany and the Netherlands scored consistently lower on all measures compared with smokers in France and the UK.

Differences on LII by country

LII scores were highest in France, followed by the UK, and were similarly low in Germany and the Netherlands (table 3). The descriptive statistics for the two survey modes in the Netherlands show notable differences with web respondents scoring lower on the LII, and telephone respondents scoring similar to the German sample.

Differences on LII by demographics

Table 4 presents mean LII scores by country and demographics. There were no significant effects of sex or minority status. Across all countries, respondents with lower vs. higher incomes scored higher on the LII, $F_{3,6142} = 5.44$, $P = 0.001$, with no significant interaction between country and income. There was a main effect of age, $F_{3,6142} = 7.67$, $P < 0.001$ and a country \times age interaction, $F_{9,6142} = 3.77$, $P < 0.001$. In most countries, smokers aged ≥ 55 years tended to have higher LII scores than younger smokers, with the exception of the UK. There was a main effect of education, $F_{2,6142} = 5.46$, $P = 0.004$, as well as a country \times education interaction, $F_{6,6142} = 4.62$, $P < 0.001$. Although scores on the LII tended to be higher among smokers with low to moderate education in France, Germany and the Netherlands, the opposite trend was observed in the UK.

Differences on LII by smoking behaviour

Table 4 presents mean LII scores by country and smoking behaviour. Across all countries, respondents who smoked fewer cigarettes per day as well as those who had made a quit attempt in the past year scored

significantly higher on the LII, $F_{3,6142} = 31.20$, $P < 0.001$ and $F_{1,6142} = 5.90$, $P = 0.015$ respectively. There was a main effect of time to first cigarette, $F_{3,6142} = 4.35$, $P = 0.005$ and a significant country \times time to first cigarette interaction, $F_{9,6142} = 3.00$, $P = 0.001$. In general, smokers who smoked their first cigarette > 5 min after waking had higher LII scores. There was also a main effect of quit intentions across countries, $F_{1,6142} = 139.03$, $P < 0.001$, and a significant country \times quit intentions interaction, $F_{3,6142} = 3.05$, $P = 0.028$. In general, smokers with stronger intentions to quit had higher LII scores.

Discussion

This study demonstrates that in addition to the size, format and content of the warnings, that country is also associated with health warning effectiveness. Effectiveness, as measured by the LII, was highest in France, lower in the UK, and lowest in Germany and the Netherlands. Differences in LII scores were larger than expected, with Germany and the Netherlands scoring particularly low.

Differences across countries could be explained by several factors. The two countries with the lowest scores on the LII, Germany and the Netherlands, have the least comprehensive tobacco control programmes [as indicated by 2007 Tobacco Control Scale (TCS) scores].^{30,31} On the 2007 TCS, the UK ranked 1st with 93 points, France 7th with 59 points, the Netherlands 14th with 50 points and Germany 27th with 37 points. Thus, there seems to be an association between the comprehensiveness of tobacco control programmes and warning effectiveness. Indeed, Levy *et al.*³² discussed that certain policies, such as anti-smoking mass media, have been found to be effective when integrated with other tobacco control policies (i.e. raising cigarette taxes and smoke-free laws).

It is likely that factors related to the tobacco control environment not captured in the TCS also contributed to the differences. For example, the TCS does not measure how tobacco control policies are portrayed in the media and social norms towards smoking. Smoking prevalence rates, both historic and current, and patterns of cigarette consumption may have also played a role. Prevalence of current smoking varies across the four countries, rates for women and men, respectively, are: UK (20 and 22%), Germany (26 and 34%), the Netherlands (24 and 30%) and France (30 and 37%).^{33–36} Even though the prevalence is highest in France, where the LII was also highest, cigarette consumption (cigarettes per day) is lower compared with the other countries and the EU average.³⁷ Thus, if attitudes towards smoking, particularly heavy smoking, are more negative in countries with lower prevalence, such as the UK, or lower cigarette consumption such as in France, smokers may feel more pressure to quit and be more receptive to the health warnings.

Thus, it may be in countries with more comprehensive tobacco control programmes (higher TCS), and other indicators of a strong tobacco control environment, that health warnings are more effective, possibly via favourable effects of the tobacco control environment on smokers' receptivity to the warnings. Unknown cultural differences, such as receptivity to regulation of health behaviour, could have also played a role.

Overall, smokers who smoked fewer cigarettes per day and had made an attempt to quit in the last year had higher LII scores. The relation found between greater intentions to quit smoking and higher LII scores

Table 3 Measures of warning label effectiveness and LII by country^{a,b}

Labels measure	DE	FR	UK	NL ^c	NL Tel ^d	NL Web ^d	Test ^e	df	P
Warning salience	39.5 ^(a)	68.7 ^(b)	64.6 ^(b)	29.5 ^(a)	37.7	27.6	189.81	3	<0.001
Thoughts of harm	7.3 ^(a)	49.2 ^(b)	14.9 ^(c)	1.9 ^(a)	4.7	1.3	493.19	3	<0.001
Thoughts of quitting	3.5 ^(a)	7.1 ^(a,b)	7.6 ^(b)	1.5 ^(a,b)	4.1	0.9	10.86	3	0.013
Forgoing of cigarettes	6.8 ^(a)	20.6 ^(b)	10.6 ^(a)	7.0 ^(a,b)	10.3	6.3	57.46	3	<0.001
LII	-1.74 ^(a)	3.20 ^(b)	0.39 ^(c)	-2.31 ^(a)	-1.37	-2.52	112.07	3, 6142	<0.001

a: All estimates are percentages, with the exception of the LII, which is the mean score in each country.

b: Countries having different letters in italics within parentheses are significantly different at the $\alpha = 0.05$ level (with Bonferroni correction) in the models adjusting for demographics and smoking behaviour.

c: NL = NL Tel + NL Web, all statistical analyses use combined NL sample.

d: Tel = respondents surveyed by telephone; web = respondents surveyed by web.

e: Test for LII is the F -test, test for other label measures is Wald χ^2 -test from logistic model.

Table 4 Mean label impact scores by demographic and smoking behaviour characteristics^a

Characteristic	DE	FR	UK	NL ^b	NL tel ^c	NL web ^c	ME ^d
Sex							
Male	-1.70	3.17	0.25	-2.55	-1.64	-2.75	-0.27
Female	-1.79	3.24	0.51	-2.04	-1.04	-2.26	-0.08
Age ^e (years)							
18-24	-2.01	3.64	0.15	-2.49	-1.41	-2.79	0.22
25-39	-2.21	2.43	0.88	-2.58	-2.17	-2.67	-0.23
40-54	-1.62	3.39	0.19	-2.87	-1.98	-3.07	-0.45
≥55	-1.00	4.01	-0.01	-1.11	0.48	-1.46	0.09
Minority status							
Majority group	-1.78	3.08	0.41	-2.30	-1.48	-2.48	-0.26
Minority group	-0.86	3.92	0.08	-2.41	-0.49	-2.99	0.72
Income ^f							
Low	-1.48	3.93	0.91	-1.89	-0.84	-2.09	0.73
Moderate	-1.59	3.40	-0.13	-2.31	-0.61	-2.63	-0.06
High	-2.19	2.14	0.58	-2.46	-2.49	-2.46	-0.52
Not reported	-1.86	3.44	-0.21	-2.39	-0.80	-2.76	-1.53
Education ^e							
Low	-1.15	3.78	0.03	-2.30	-0.69	-2.54	0.32
Moderate	-1.83	2.74	0.72	-2.04	-1.11	-2.28	-0.35
High	-2.00	2.54	1.22	-2.99	-2.60	-3.12	-0.85
Cigarettes/day (cpd) ^f							
0-10	-1.11	4.02	1.53	-1.46	-0.49	-1.68	1.15
11-20	-1.73	2.64	0.20	-2.45	-1.17	-2.72	-0.54
21-30	-2.60	1.77	-0.74	-3.14	-3.02	-3.16	-1.75
31+	-4.13	0.28	-2.48	-4.27	-3.98	-4.38	-2.97
Time to first cigarette ^e (min)							
61+	-1.54	3.72	1.56	-1.54	-0.43	-1.78	0.76
31-60	-1.01	3.05	1.01	-1.99	-0.71	-2.40	0.34
6-30	-1.96	3.07	0.29	-2.63	-1.58	-2.86	-0.50
Within 5	-3.96	2.29	-1.07	-2.54	-2.49	-2.55	-1.45
Intentions to quit ^e							
In next 6 months	0.03	4.25	2.53	-0.28	1.70	-0.78	2.04
Otherwise	-2.35	2.53	-0.75	-2.85	-2.29	-2.97	-1.11
Past year quit attempts ^f							
No attempt	-2.02	2.90	0.27	-2.61	-2.06	-2.74	-0.41
At least one	-0.90	4.06	1.13	-1.42	0.78	-1.89	0.61
Country main effect ^f	-1.74	3.20	0.39	-2.31	-1.37	-2.52	-0.18 ^g

a: DE = Germany, FR = France, UK = United Kingdom, NL = Netherlands.

b: NL = NL Tel + NL Web, all statistical analyses use combined NL sample.

c: Tel = respondents surveyed by telephone; web = respondents surveyed by web.

d: Main effect (ME) of covariate.

e: Significant interaction between country and covariate.

f: Significant main effect.

g: Overall mean LII score.

corresponds to previous studies.^{8,20} Together, these findings suggest that health warnings could help smokers prepare to quit.

Smokers with the lowest net household incomes had higher LII scores across all countries. Similarly, LII scores were higher among smokers with low to moderate education compared with higher education in all countries, with the exception of the UK. The 2008 Eurobarometer similarly found that manual workers and less-educated individuals were somewhat more likely to rate health warnings as effective.⁹

Because the addition of pictures to health warnings has been found to enhance effectiveness,^{12,15,17,18,38,39} the impact of the text-only warnings could be increased by implementing pictorial warnings across the EU. Indeed, the 2008 Eurobarometer showed that 55% of smokers and non-smokers in the 25 countries surveyed without pictorial warnings thought that adding pictures to warnings could be somewhat or very effective in illustrating the health effects of smoking [France (55%), Germany (55%) and the Netherlands (38%)], and the 2009 Eurobarometer showed that 75% favour their introduction.^{9,37} Since this study was conducted, the UK and France implemented the EU pictorial warning labels, the Netherlands and Germany have neither implemented them or announced plans to do so.

Limitations

Because self-reported measures were used, social desirability had the potential to affect results. For instance, in countries with negative social

norms towards smoking, smokers may have felt the need to say they intended to quit. Although, smokers' responses to the health warnings were self-reported, the cognitive and behavioural measures used in this study have been shown to prospectively predict quit attempts in other populations, lending support for their use as indicators of health warning effectiveness.¹⁰

Because the Netherlands had the warnings in place the longest, 'wear out' of the health warnings could also be said to be an explanation for the lower LII in the Netherlands. A study by Willemsen⁸ found that when the warnings were introduced in the Netherlands, 84% of smokers reported noticing the warnings and 18% reported motivation to quit because of them, compared with the 29.5% that noticed the warnings in the current study and the 1.5% that reported being more likely to quit because of them.⁸ However, it is likely that these initial high levels of noticing found by Willemsen⁸ were due to the 'novelty' of the new warnings.

Nuances in the translation of the survey questions could have had an effect on the findings, although every effort was made to ensure comparability.

Conclusions

The impact of the EU-standardized health warnings varied by country. Since warning impact was especially low in the Netherlands and Germany, these countries, in particular, may benefit from the implementation of pictorial health warnings. Additionally, because social

inequalities exist in smoking prevalence rates across the EU,^{21–24} the finding that the impact of the health warnings was highest among smokers with lower incomes and smokers with low to moderate education (except the UK in the case of education) suggests that health warnings could be more effective among low SES groups, and should be further investigated as pictorial warnings are adopted in EU countries.

Supplementary data

Supplementary data are available at *EURPUB* online.

Acknowledgements

We would like to acknowledge the work of Lorraine Craig, International Tobacco Control Project Europe Manager, and the Data Management Centre at the University of Waterloo.

Funding

National Health and Medical Research Council of Australia (265903) and (450110); Cancer Research UK (C312/A6465); U.S. National Cancer Institute (RO1 CA100362) and (P50 CA111236); Canadian Institutes of Health Research (79551); Ontario Institute for Cancer Research (Senior Investigator Award); French Institute for Health Promotion and Health Education (INPES); French National Cancer Institute (INCa); French Monitoring Centre for Drugs and Drug Addiction (OFDT); German Cancer Research Center; German Ministry of Health, Dieter Mennekes-Umweltstiftung; The Netherlands Organisation for Health Research and Development (ZonMw 70000001); Canadian Institutes of Health Research Doctoral Research Award (to S.C.H.); by Klaus Tschira Foundation, gGmbH (financial support to U.M.).

Conflicts of Interest: None declared.

Key points

- Using a Labels Impact Index, comprising key measures of tobacco health warning label effectiveness, the impact of the nearly identical EU standardized text-only health warnings was found to vary greatly across countries; the impact of the warnings was highest in France, lower in the UK, and the lowest in Germany and the Netherlands.
- The impact of the health warning labels was found to be highest among low-income smokers across all countries, and among smokers with lower education in all countries except the UK, suggesting that health warnings may be more effective among low SES groups. Socioeconomic differences in the impact of health warnings should be further investigated, particularly as some EU countries adopt pictorial warnings.
- Although all EU countries could benefit from the implementation of pictorial health warnings, the need for pictorial warnings is particularly strong in Germany and the Netherlands where impact of the EU standardized text-only health warnings was found to be very low.

References

- Peto R, Lopez AD, Boreham J, Thun M. Mortality from smoking in developed countries, 1950–2000. 2006. [cited 4 August 2011]. Available at: <http://www.ctsuo.ox.ac.uk/~tobacco/C0002.pdf>.
- World Health Organization. WHO Framework Convention on tobacco control. 2003. [cited 21 May 2010]. Available at: <http://whqlibdoc.who.int/publications/2003/9241591013.pdf>.
- Hammond D, Fong GT, McNeill A, et al. Effectiveness of cigarette warning labels in informing smokers about the risks of smoking: findings from the International Tobacco Control (ITC) Four Country Survey. *Tob Control* 2006;15(Suppl. 3):iii19–25.
- Moodie C, MacKintosh AM, Hammond D. Adolescents' response to text-only tobacco health warnings: results from the 2008 UK Youth Tobacco Policy Survey. *Eur J Public Health* 2010;20:463–9.
- Portillo F, Antoñanzas F. Information disclosure and smoking risk perceptions: potential short-term impact of the new European Union directive on tobacco products. *Eur J Public Health* 2002;12:295–301.
- Hammond D, Fong GT, McDonald P, et al. Impact of the Canadian graphic warning labels on adult smoking behaviour. *Tob Control* 2003;12:391–5.
- Willemsen MC, Simons C, Zeeman G. Impact of the new EU health warnings on the Dutch quit line. *Tob Control* 2002;11:381–2.
- Willemsen MC. The new EU cigarette health warnings benefit smokers who want to quit the habit: results from the Dutch Continuous Survey of Smoking Habits. *Eur J Public Health* 2005;15:389–92.
- European Commission. Survey on tobacco: analytical report. Flash Eurobarometer 253. 2009. [cited 28 June 2010]. Available at: http://ec.europa.eu/public_opinion/flash/fl_253_en.pdf.
- Borland R, Yong H-H, Wilson N, et al. How reactions to cigarette packet health warnings influence quitting: findings from the ITC-Four Country survey. *Addiction* 2009;104:669–75.
- Borland R, Hill D. Initial impact of the new Australian tobacco health warnings on knowledge and beliefs. *Tob Control* 1997;6:317–25.
- Fong GT, Hammond D, Hitchman SC. The impact of pictures on the effectiveness of tobacco warnings. *Bull World Health Organ* 2009;87:640–3.
- European Commission. Directive 2001/37/EC of the European Parliament and of the Council of 5 June 2001 on the approximation of the laws, regulations and administrative provisions of the Member States concerning the manufacture, presentation and sale of tobacco products. *OJ* 2001;L194:26–34.
- European Community. Council Directive 89/622/EEC of 13 November 1989 on the approximation of the laws, regulations and administrative provisions of the Member States concerning the labelling of tobacco products. *OJ* 1989;L359:1–4.
- Hammond D, Fong GT, Borland R, et al. Text and graphic warnings on cigarette packages: findings from the International Tobacco Control Four Country Study. *Am J Prev Med* 2007;32:202–9.
- Hassan LM, Shiu E, Thrasher JF, et al. Exploring the effectiveness of cigarette warning labels: findings from the United States and United Kingdom arms of the International Tobacco Control (ITC) Four Country Survey. *Int J Nonprofit Volunt Sect Mark* 2008;13:263–74.
- Borland R, Wilson N, Fong GT, et al. Impact of graphic and text warnings on cigarette packs: findings from four countries over five years. *Tob Control* 2009;18:358–64.
- Gallopel-Morvan K, Gabriel P, Le Gall-Ely M, et al. The use of visual warnings in social marketing: the case of tobacco. *J Bus Res* 2011;64:7–11.
- Delvin E, Anderson S, Hastings G, MacFadyen L. Targeting smokers via tobacco product labelling: opportunities for Pan European health promotion. *Health Promot Int* 2005;20:41–9.
- Thrasher JF, Hammond D, Fong GT, Arillo-Santillán E. Smokers' reactions to cigarette package warnings with graphic imagery and with only text: a comparison between Mexico and Canada. *Salud Pública Méx* 2007;49(Suppl. 2):S233–40.
- Cavelaars AEJM, Kunst AE, Geurts JJM, et al. Educational differences in smoking: international comparisons. *Br Med J* 2000;320:1102–7.
- Giskes K, Kunst AE, Benach J, et al. Trends in smoking behaviour between 1985 and 2000 in nine European countries by education. *Epidemiol Commun Health* 2005;59:395–401.
- Schaap MM, Kunst AE, Leinsalu M, et al. Effect of nationwide tobacco control policies on smoking cessation in high and low educated groups in 18 European countries. *Tob Control* 2008;17:248–55.
- Mackenbach J. Inequalities in lung cancer mortality by the educational level in 10 European populations. *Eur J Cancer* 2004;40:126–35.
- Nagelhout GE, Willemsen MC, Thompson ME, et al. Is web interviewing a good alternative to telephone interviewing? Findings from the International Tobacco Control (ITC) Netherlands Survey. *BMC Public Health* 2010;10:351.
- International Tobacco Control Policy Evaluation Project. ITC France National Report. 2009. [cited 28 June 2010]. Available at: <http://www.itcproject.org/keyfindi/itcfrance>.
- International Tobacco Control Policy Evaluation Project. ITC Germany Technical Report, Waves 1–2. 2010. [cited 11 January 2011]. Available at: http://www.itcproject.org/documents/countries/germany/de_w12_techreport_july6_2010revpdf.
- International Tobacco Control Policy Evaluation Project. ITC Netherlands Technical Report, Waves 1–3. 2009. [cited 11 January 2011]. Available at: http://www.itcproject.org/documents/countries/netherlands/nl_w13_techreport_july62010revpdf.

- 29 Thompson ME, Fong GT, Hammond D, et al. Methods of the International Tobacco Control (ITC) Four Country Survey. *Tob Control* 2006;15(Suppl. 3):iii12–8.
- 30 Joossens L, Raw M. The Tobacco Control Scale: a new scale to measure country activity. *Tob Control* 2006;15:247–53.
- 31 Joossens L, Raw M. Progress in tobacco control in 30 European Countries, 2005–2007. [cited 26 June 2010]. European Network for Smoking Prevention. Available at: http://www.european-cancer-leagues.org/DOSS/uploaded/290_30_european_countries_text_final.pdf.
- 32 Levy DT, Chaloupka F, Gitchell J. The effects of tobacco control policies on smoking rates: a tobacco control scorecard. *J Public Health Manag Pract* 2004;10:338–53.
- 33 Office for National Statistics, Smoking and drinking among adults. A report on the 2009 General Lifestyle Survey. 2009. [cited 15 March 2011]. Available at: http://www.statistics.gov.uk/downloads/theme_compendia/GLF09/GLFSmoking-DrinkingAmongAdults2009.pdf.
- 34 Gesundheit in Deutschland Aktuell [Current Health in Germany] (GEDA). *Telephone Health Survey*. Robert Koch Institute, 2009.
- 35 TNS NIPO. *Dutch Continuous Survey of Smoking Habits*. Amsterdam: TNS NIPO, 2009.
- 36 Beck F, Guignard R, Richard J-B, et al. Augmentation récente du tabagisme en France: principaux résultats du Baromètre santé, France, 2010. *BEH* 2011;21–22:101–3.
- 37 EUROBAROMETER 72.3, Special Eurobarometer 332, Tobacco, 27 May 2010; [cited 15 March 2011]. Available at: http://ec.europa.eu/health/eurobarometers/index_en.htm.
- 38 O'Hegarty M, Pederson LL, Nelson DE, et al. Reactions of young adult smokers to warning labels on cigarette packages. *Am J Prev Med* 2006;30:467–73.
- 39 Vardavas CI, Connolly G, Karamanolis K, Kafatos A. Adolescents' perceived effectiveness of the proposed European graphic tobacco warning labels. *Eur J Public Health* 2009;19:212–7.

European Journal of Public Health, Vol. 22, No. 5, 699–704

© The Author 2011. Published by Oxford University Press on behalf of the European Public Health Association. All rights reserved.
doi:10.1093/eurpub/ckr108 Advance Access published on 5 September 2011

Predicting the future prevalence of cigarette smoking in Italy over the next three decades

Giulia Carreras¹, Giuseppe Gorini¹, Silvano Gallus², Laura Iannucci³, David T. Levy⁴

¹ Environmental & Occupational Epidemiology Unit, Cancer Prevention & Research Institute (ISPO), Florence, Italy

² Department of Epidemiology, Mario Negri Institute for Pharmacological Research, Milan, Italy

³ Italian National Institute of Statistics (ISTAT), Rome, Italy

⁴ Pacific Institute for Research and Evaluation; Department of Economics, University of Baltimore, Baltimore, USA

Correspondence: Giuseppe Gorini, Environmental & Occupational Epidemiology Unit, Cancer Prevention & Research Institute (ISPO), Ponte Nuovo - via delle Oblate, 2 – 50141 Florence, Italy, tel: +39 055 7972562, fax: +39 055 7972588, e-mail: g.gorini@ispo.toscana.it

Background: Smoking prevalence in Italy decreased by 37% from 1980 to now. This is due to changes in smoking initiation and cessation rates and is in part attributable to the development of tobacco control policies. This work aims to estimate the age- and sex-specific smoking initiation and cessation probabilities for different time periods and to predict the future smoking prevalence in Italy, assuming different scenarios. **Methods:** A dynamic model describing the evolution of current, former and never smokers was developed. Cessation and relapse rates were estimated by fitting the model with smoking prevalence in Italy, 1986–2009. The estimated parameters were used to predict prevalence, according to scenarios: (1) 2000–09 initiation/cessation; (2) half initiation; (3) double cessation; (4) Scenarios 2 + 3; (5) triple cessation; and (6) Scenarios 2 + 5. **Results:** Maintaining the 2000–09 initiation/cessation, the 10% goal will not be achieved within next three decades: prevalence will stabilize at 12.1% for women and 20.3% for men. The goal could be rapidly achieved for women by halving initiation and tripling cessation (9.9%, 2016), or tripling cessation only (10.4%, 2017); for men halving initiation and tripling cessation (10.8%, 2024), or doubling cessation and halving initiation (10.5%, 2033), or tripling cessation only (10.8%, 2033). **Conclusion:** The 10% goal will be achieved within the next few decades, mainly by increasing smoking cessation. Policies to reach this goal would include increasing cigarette taxes, introducing total reimbursement of smoking cessation treatment, with a further development of quitlines and smoking cessation services. These measures are not yet fully implemented in Italy.

Introduction

In Italy, male smoking prevalence declined from 41.6% in 1986 to 29.5% in 2009, an average annual drop of 1.2%. Meanwhile, female smoking prevalence declined from 19.2% in 1986 to 17.0% in 1993, and stalled at that level.¹

The reduction in smoking prevalence was in part attributable to the development of tobacco control policies in Italy from the 1970s onwards. A smoking ban in hospitals, schools, cinemas and public transportations was introduced in 1975, followed by a smoking ban in front-offices of public administrations in 1995, and finally by a comprehensive smoking ban in all workplaces and in the hospitality sector in 2005.² Since 1991 tobacco advertising and promotion were almost totally banned in Italy, as in most European countries.³ Moreover, the real price of cigarettes in 1990–2000 increased at an annual 3% rate.⁴ The price for a pack of Marlboro, standardized for consumer price index, remained stable between 1990 and 2003, then increased by 25% between 2003 and 2009

(at annual 4% rate). Moreover, after the trial against Philip Morris and RJ Reynolds brought by the European Community, smuggling in Italy dropped from ~15% of cigarette trades in 1998 to 1–2% in 2006, further decreasing to <1% in 2008.⁵ Finally, since the end of the 1990s several smoking cessation services (SCS) were established, including about 260 National Health System (NHS) SCS, about 80 Italian League against Cancer (LILT; a non-governmental organization) smoking cessation centres and two National quitlines.² The implementation of these policies notwithstanding, male smoking prevalence in Italy is today relatively high, compared with several North European countries and the USA.

A recent report of the US Institute of Medicine on the future of tobacco control suggested a 10% threshold as a policy goal for the USA.⁶ No policy target for smoking prevalence is available for Italy and Europe.

The aim of this article is to estimate the smoking cessation and initiation rates needed to reduce smoking prevalence to 10% for both